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REVIEW LINEAR AND NONLINEAR APPLIED PROBLEMS OF VISCOELASTICITY

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Abstract: The article proves the effectiveness of algorithms for solving linear and nonlinear problems of vibrational and dynamic stability as one of the priority areas in the mechanics of composite materials.

Keywords: linear problems, nonlinear problems, aeroviscoelastic stability problem, weakly singular level, integro-differential control.

There are many problems in the world, such as deformation, durability, vibration and dynamic stability of structures made of composite materials, and the study of these problems is important . task. The study of these problems in the context of composite materials helps to solve many problems of the aerospace industry, such as the weight, strength and reliability of the object during development and design. Interest in the problems of deformation, durability, vibration and dynamic stability of structures made of composite materials is due to the fact that they are the main load-bearing elements in the structure, etc. The high demand for reliable structural elements made of modern composite materials in mechanical engineering requires the improvement of mathematical and mechanical models of viscoelastic systems. Therefore, the development of efficient algorithms for solving linear and nonlinear problems of vibrational and dynamic stability has become one of the priorities in the mechanics of composite materials. Many constants of composite materials are related to their viscoelastic properties.

The study of dynamic processes in structures is one of the important tasks of the dynamics of deformable systems. Flutter phenomena often occur in such structures . These phenomena can be explained in other words, that self-oscillations occur in a gas or liquid flow on rods or plates. Self-oscillations can be undamped, or resonant phenomena occur in the rods of a gas flow or air. Oscillatory phenomena in a plate (or rod) during flutter leads to a loss of stability of structures [1; 2; 3; four].

To exclude the possibility of flutter, always strive to ensure that the center of gravity in the sections is ahead of the center of rigidity. However, it is very difficult and almost impossible to implement this constructively. It should be noted that the nature of stability depends significantly on the geometric and physical-mechanical parameters of structures, as well as on the speed of air flows. It is determined that at low speeds the mechanical system will not lose stability, if the speed reaches a certain critical value, then the system becomes unstable.

Recently, there has been an increased interest in nonlinear problems of aeroviscoelasticity and, in particular, in nonlinear problems of a hereditarily deformable panel flutter. This is mainly due to two reasons. First, the natural desire to reduce the discrepancies observed in many cases between the data of theory and experience or to find rational explanations for them. Secondly, to obtain some initial data for assessing the fatigue strength of the material of shell structures.

To evaluate alternating stresses, it is necessary to know the oscillation amplitudes of the limit cycles, which can only be determined when solving a nonlinear problem.

Nonlinear problems of panel flutter can be determined by both physical, geometric, and aerodynamic factors individually and in combination. Thus, the problem of aeroviscoelastic stability can be non-linear physically - aerodynamically , geometrically- aerodynamically , or the combination of these non-linearities i.e. physically, geometrically and aerodynamically non-linear. This is a natural classification, on the one hand, it simplifies the study of linear and nonlinear problems at the initial stage, and on the other hand, it makes it possible to better trace the role of “individual nonlinearities”.

The usual way to solve linear and nonlinear problems is to reduce the system of weakly singular integro-differential equations in partial derivatives, using the Bubnov -Galerkin method, finite differences or the finite element method, to a system of weakly singular ordinary nonlinear integro-differential equations. In the future, this system can be numerically integrated into modern personal computers. Description of methods for solving the last most general cases of nonlinear problems is a rather difficult task.

As is known, most of the problems of oscillations in the mechanics of hereditary - deformable systems, usually mathematically formed using linear integro-differential equations, with a rigorous approach, generally speaking, are nonlinear, i.e. these problems should be described by nonlinear integro-differential equations with partial derivatives with variable coefficients. The linearization of such problems (both geometrically and physically) is carried out solely in order to eliminate the mathematical difficulties associated with nonlinear integral and integro-differential equations. In a number of papers, in order to overcome these difficulties, restrictive conditions are introduced on the nonlinear parts of the equations and on the integral terms. With such restrictions, some important cases are not covered, when the nonlinear parts of the equations and the integral terms, which take into account the hereditary properties of materials, significantly affect the solution of the problem.

Therefore, to develop a clear recommendation to designers so that the structures do not collapse and be safe when exposed to various types of static, dynamic and aerodynamic loads in all operating modes during a given period of its operation is a very relevant, global problem today.

LITERATURE :

1. Grigorios D. Introduction to nonlinear aeroelasticity – John Wiley & Sons, Inc., 2017, pp. 573.
2. Гроссман Е.П. Курс вибраций частей самолета. – М., Оборонгиз, 1940, 310с.
3. Feng-MingLi, Zhi-Guang S. Flutter and thermal buckling control for composite laminated panels in supersonic flow // Journal of Sound and Vibration V. 332, 2013, pp. 5678–5695.
4. Prakash T., Ganapathi M. Supersonic flutter characteristics of functionally graded flat panels including thermal effects // Composite Structures 72, 2006, pp. 10-18.
5. Usmonov B., Rakhimov Q., Akhmedov A. Analysis of numerical solutions of a hereditary deformable system // International Journal of Mechanical and Production Engineering Research and Development (IJMPERD), Vol. 8, Issue 4, Aug 2018, 403-408. http://dx.doi.org/10.24247/ijmperdaug201842
6. Усмонов Б., Рахимов К. Построение математической модели в прямой постановке задачи изгибно-крутильного колебания наследственно - деформируемого крыла самолета, Проблемы вычислительной и прикладной математики // Problems of computational and applied mathematics, № 5 (29) 2020, стр 108-119.
7. INTER, FIBER LENGTH IN. "An International Multidisciplinary Research Journal." *An International Multidisciplinary Research Journal* 41.43 (2017).

8. Jo‘rayev, V. T. (2019). The advantage of distance learning courses in the process of education. *Scientific Bulletin of Namangan State University*, *1*(9), 220-224.
9. Jo‘rayev, V. T. (2020). The Role and Advantages Of Distance Courses In The Innovative Educational System. *The American Journal of Social Science and Education Innovations*, *2*(10), 434-439.
10. Jurayev, V. T. (2020). PEDAGOGICAL SOFTWARE IN THE PREPARATION OF FUTURE TEACHERS OF INFORMATICS IN AN INNOVATIVE ENVIRONMENT. *Theoretical & Applied Science*, (4), 182-185.